

In the Claims:

Please cancel claim 20, without prejudice.

Please amend the remaining claims as follows:

1(Sixth Amendment). In combination with a swivel joint forming a flow passage and having a central axis, the improvement comprising:

HH  
a hollow tubular male connector having a first end, an annular outer surface and a plurality of outer annular grooves formed on said outer surface concentric with said central axis, wherein each said outer groove comprises a generally arcuate cross-section and a radius measured from said central axis, and wherein the radius of each said outer groove is greater than the radius of each adjacent outer groove closer to said first end;

a hollow tubular female connector having an annular recess adapted to receive and fit around said outer surface and a plurality of inner annular grooves formed on said annular recess concentric with said central axis, said recess forming a shoulder within said female connector adjacent said first end, wherein each said inner groove comprises a generally arcuate cross-section and a radius measured from said central axis, and wherein the radius of each said inner groove is greater than the radius of each adjacent inner groove closer to said shoulder, said inner grooves each corresponding to one of said outer grooves and forming therewith an arcuate race; and

a plurality of ball bearings received in each race to secure said male and female connectors together and to facilitate relative rotation of said male and female connectors about said central axis;

wherein the cross-section of at least each outer groove or each inner groove comprises first and second arcuate segments each having a distinct centerpoint and substantially the same radius; and

wherein the centerpoint of the first segment is offset from the centerpoint of the second segment in a direction parallel to the central axis; and

wherein the radius of the first and second segments is substantially the same as the radius of the ball bearings positioned in the race formed by the corresponding outer or inner groove.

In claim 5, at line 3, change "fir" to - - fit - -.

5 ~~12~~ (Second Amendment). A bearing assembly according to claim 1, wherein [each said inner groove has a section located at the apex of the generally arcuate cross-section comprising a straight line segment] the cross-section further comprises a straight line segment connecting said first and second arcuate segments.

6 ~~13~~ (Fourth Amendment). A bearing race assembly for use in a swivel joint comprising:

a pair of opposed tube-shaped connecting members each having a central axis coaxial with the other and each having a plurality of outer annular grooves, said members being positioned such that a first end of each is adjacent to the other, each groove having a generally arcuate cross-section and a radius measured from said central axis, wherein the radius of each said outer groove on a respective connecting member is greater than the radius of each adjacent outer groove closer to said first end on said respective connecting member;

a collar coaxially aligned with said connecting members and adapted to receive and fit around said connecting members, said collar having a plurality of inner annular grooves each having a generally arcuate cross-section and a radius measured from said central axis, wherein the radius of each said inner groove is greater than the radius of each adjacent inner groove closer to said first end of each said connecting member, said inner grooves each corresponding to one of said outer grooves and forming therewith an arcuate race; and

a plurality of ball bearings received in each race to facilitate relative rotation of said connecting members and said collar about said central axis;

wherein the cross-section of at least each outer groove or each inner groove comprises first and second arcuate segments each having a distinct centerpoint and substantially the same radius; and

wherein the centerpoint of the first segment is offset from the centerpoint of the second segment in a direction parallel to the central axis; and

wherein the radius of the first and second segments is substantially the same as the radius of the ball bearings positioned in the race formed by the corresponding outer or inner groove.

H3  
14/18 (Amended).

A bearing assembly according to claim [1], ~~13~~, wherein

[each said outer groove has a section located at the apex of the generally arcuate cross-section comprising a straight line segment] the cross-section further comprises a straight line segment connecting said first and second arcuate segments.

H4  
11/19 (Fourth Amendment).

A swivel joint comprising:

H5  
a central axis;

a hollow tubular male connector having an outer annular surface, a first end and at least first and second outer annular grooves formed on the outer surface concentric with the central axis;

a hollow tubular female connector having an inner annular recess forming an inner annular shoulder and at least first and second inner annular grooves formed on the inner recess concentric with the central axis;

wherein the inner recess is adapted to receive and overlap the outer surface such that the first end is adjacent the inner annular shoulder and each inner groove is in alignment with a corresponding outer groove to thereby define at least first and second arcuate races;

wherein the diameter of each arcuate race is greater than the diameter of each adjacent arcuate race closer to the first end of the male connector; and

15 a plurality of ball bearings received in each race to secure said male and female connectors together and to facilitate relative rotation of the male and female connectors about the central axis;

wherein the male and female connectors form a flow passage of the swivel joint;

wherein the cross-section of at least each outer groove or each inner groove comprises first and second arcuate segments each having a distinct centerpoint and substantially the same radius; and

wherein the centerpoint of the first segment is offset from the centerpoint of the second segment in a direction parallel to the central axis; and

H5 wherein the radius of the first and second segments is substantially the same as the radius of the ball bearings positioned in the race formed by the corresponding outer or inner groove.

Please add the following new claims:

15/24. A swivel joint according to claim 1, wherein the radii of the inner and outer grooves are determined as a function of the radius of the ball bearings and the cross sectional areas of the male and female connectors at at each race.

16/25. A bearing race assembly according to claim 13, wherein the radii of the inner and outer grooves are determined as a function of the radius of the ball bearings and the cross sectional areas of the male and female connectors at at each race.

17/26. A swivel joint according to claim 16, wherein the diameters of the races are determined as a function of the radius of the ball bearings and the cross sectional areas of the male and female connectors at at each race.

H6 27. A swivel joint comprising:  
a central axis;  
a hollow tubular male connector having an outer annular surface, a first end and at least first and second outer annular grooves formed on the outer surface concentric with the central axis;  
a hollow tubular female connector having an inner annular recess forming an inner annular shoulder and at least first and second inner annular grooves formed on the inner recess concentric with the central axis;  
wherein the inner recess is adapted to receive and overlap the outer surface such that the first end is adjacent the inner annular shoulder and each inner